Project Proposal

Proposal Title: **Tamarisk Beetle Distribution Monitoring** **Proposal Number:** 1415

DWR Region: Southeastern Region **Lead Agency:** Other **County:** Grand

Project Manager: Tim Higgs **PM Phone:** 4356133717 **Regional Priority:** Within Focus Area

Project Type: Miscellaneous **Proposed Start Date:**

Project Location: The project boundaries encompasses the majority of Grand County in areas in which tamarisk can become established.

Project Description: In 2004, the tamarisk beetle was released to help control tamarisks throughout the Grand County. The project is to provide funding so continued systematic monitoring of tamarisk beetle movements and subsequent responses of tamarisk can continue.

Description of Problem/Need: This project is essential for maintaining an established, continuous program of study addressing various aspects of beetle-tamarisk interactions and for maintaining the value and integrity of the developing, baseline data file that can play a key role in helping to safeguard our fragile desert ecosystems. Grand County encompasses an area of 3694 mi2 (2,364,160 acres) and, as of October 2008, the beetles had affected over half of that area, approximately 1,596,309 acres

Limited observations near release sites were made from 2004 to 2006. The Grand County Weed Department began systematically monitoring beetle movements and subsequent responses of tamarisk in 2007. Data on beetles and tamarisk were collected from 1 June to 5 October 2007 and from 5 May to 6 October 2008. Monitoring was expanded in 2008 to cover the beetle's extensive spread.

The observation methods used were based on a USDA APHIS protocol where target trees with a tagged target branch were selected throughout the county. Data gathered from these trees included GPS location of each target tree, tree condition, and numbers of beetles, by developmental stage, on the tree. In both years, monitoring began as early in the spring as the support grant allowed and continued until adult beetles entered diapause. In 2007, we monitored beetles two days a week for 19 consecutive weeks; in 2008, there were 15 data collection cycles, where each cycle was seven to fourteen days. Cycle lengths differed over time because of the greater area that needed to be covered. We also routinely looked for evidence of alterations in feeding habits by these beetles within this fragile high desert environment.
Since their release in 2004, the tamarisk beetle population has grown exponentially as it spread across Grand County, as evidenced by the expansion of the area covered by defoliated tamarisks. Areal extent of browning was estimated to be less than 4 ac in 2005, roughly 995 ac in 2006, rising to 10,000 ac in 2007, and by 2008, beetle induced browning covered an area of approximately 1,600,000 ac.

The tamarisk-Diorhabda elongata interaction has been studied in labs and field cages, but these studies do not provide data on the dynamics of beetle-tamarisk interactions at the landscape level. Beetle populations "slosh" back and forth along riparian corridors defoliating tamarisk, disperse to new territories, then subsequent generations re-colonize stands previously defoliated. Timing of defoliation, re-foliation, and re-colonization over a season or over years determine how quickly D. elongata kill tamarisks. Understanding this dynamic process is essential for managers trying to balance tamarisk control with other resources as the beetle–tamarisk interactions play out across the Southwest.

Our monitoring data can help guide informed management of resources and provide valuable information to assess potential conflicts with other management goals (e.g., protection of the Southwestern Willow Flycatcher).

The research project we are proposing is a 7-pronged approach to better understanding the dynamics of the Tamarix spp.–Diorhabda elongata interactions at the landscape level in southeastern Utah. This understanding begins with funding to continue the established and extensive countywide monitoring protocol already in place in Grand County, Utah. This project has been conducted for the past two years and funding for at least the next five years will be critical for establishing a valuable database that tracks the movements of adult beetle populations in the wild and documents the responses of tamarisk plants to herbivory by the adult and larval stages. Continued monitoring is necessary to provide the trends, patterns, and ever-changing dynamics revealed for these two interacting populations. This information is needed by land managers in regions of the Southwest that are now dealing with these beetles, or in those regions that will be affected by them in the future, to make informed management decisions about tamarisk. (Work covers 9 months.)

Because nature abhors a void, as tamarisk stands are defoliated and slowly killed by beetles, other plants will move in to replace them. We have begun looking at which plants are taking advantage of this open real estate. Knowledge of this natural re-vegetation is important to understand because some plant communities are more desirable than others for the benefit of wildlife as well as for aesthetic purposes.

Within a healthy tamarisk thicket sunlight is so restricted that few, if any, competing plants can be found. However, as the beetles defoliate the branches of these trees, light penetrates to the ground, and pioneer plants move in to take advantage of the opportunity. Over time, the denuded branches of dying tamarisk allow more sunlight to penetrate to the soil layer on a continuous basis and more plants respond. We intend to focus our work in areas that have not had additional manipulation by humans because the vast majority of tamarisk-occupied land falls into this category. It is critical that the response of vegetation communities to beetle-kill alone be carefully documented, as this will be the situation that occurs across most of the Southwest. We need to know if intervention will be necessary to end up with desirable communities or if the "right" plants eventually move in on their own.

Tracking the succession of these replacement plants is a key aspect of the research we hope to accomplish for the next few years. (Initial data gathering is 6 weeks.)

One of the most frequently asked questions and one of the most important aspects of the tamarisk – beetle project is whether or not the beetles are killing, or at least retarding growth of, the highly competitive tamarisk plants. To address these concerns, we began collecting data on the mortality of mature tamarisks in Grand County in the fall of 2008. These data show positive results from beetle activity. However, with cutting and burning projects being sponsored by the Bureau of Land Management (BLM), Forestry, Fire and State Lands (FFS), and the School & Institutional Trust Lands Administration (SITLA), it is also important to study the effects of beetle damage on the young re-sprouts that return to the cleared land from existing tamarisk root stocks. We know from data gathered this year that both adult and larval stages can be found feeding on young re-sprouts. Knowing whether these young plants are being killed at a faster or slower rate than mature trees can guide management to better effect the desired results. To accomplish this, we will establish plots in cut and/or burned areas to monitor beetle numbers and mortality over time and compare these results to mortality being found in nearby mature tamarisk stands. (Work covers 4 weeks.)
The proposed project would also study beetle activity with respect to elevation and latitude, focusing on tamarisk plants growing at their elevation limits in both the Book Cliffs and La Sal Mountains of Grand County. This aspect of beetle monitoring can be valuable for two basic reasons. First, it answers an important question about physiological limits of the beetle Diorhabda elongata in natural landscapes of southeastern Utah. Understanding these limits can help managers know (1) where to expect beetle infestations and (2) if tamarisk has elevational or latitudinal refugia from beetle attack and thus a continued source of viable seed drifting down from higher elevations or latitudes to reseed areas where tamarisks have been greatly reduced or even eliminated. The second value of elevation monitoring would be to help us understand the shifts to higher elevations in populations of both tamarisks and their beetle predator as the climate continues warming in the years to come. Not all members of an ecosystem have the same environmental requirements. This work will determine how closely the tamarisk tree and the beetle are coupled in the environment of southeastern Utah, and help determine over the years if they become disconnected as climate shifts occur. (Work covers 3 weeks: 1 week to locate trees, 2 weeks of monitoring.)

Funding for this proposal would allow us to continue our developing study of diapausing adults. As day length shortens and temperatures drop with the advent of fall, adult beetles crawl into the duff, or leaf litter, that builds up over time at the base of tamarisk trees. The beetles then spend the winter months in a physiologically induced stage of inactivity called diapause.

In fall 2008, we began an investigation into patterns of diapausing beetle abundance relative to beetle abundance during the previous summer and developed leaf litter sampling and sorting protocols. Results of this study can be used by managers on a variety of issues. For example, knowing where adult beetles are overwintering can contribute to a better understanding of beetle distribution patterns, linking observations of fall abundance with spring emergence and early impact on tamarisk. The ability to predict where beetles will be in high numbers in the spring will provide the opportunity to plan ahead for other management actions.

In addition, correlating overwintering data to where beetles were last active in high numbers the previous fall can be used to inform resource managers that are planning tamarisk control activities such as burning or cutting, during the winter. Because the beetles are dormant in the leaf litter, they are susceptible to any activity that affects the litter. Burning trees and litter may kill large populations; using a heavy mechanical device to chop down tamarisk could crush beetles or disrupt the litter layer and expose the beetles to adverse winter conditions leading to high mortality. It is possible that winter tamarisk control efforts could be counterproductive – significantly decreasing the population and thereby reducing the ability of the beetles to disperse effectively in the spring. This would extend the time necessary to achieve maximum mortality of tamarisk in an area. (Work covers 6 weeks: 2 weeks collecting, 4 weeks sorting.)
Even best laid plans can sometimes go awry. With this in mind, the importance of monitoring the activity of these herbaceous beetles relative to their feeding habits is essential now that immeasurable populations of these insects are at work in vast sections of the Southwest. The question is, “Are the beetles finding alternative food sources?” This can only be answered through continuous field observations. (Part of everyday field monitoring routine.)

Another question in the tamarisk – beetle equation is, “Do tamarisk trees do better if beetle-free in May?” The logic behind this question stems from the idea that the potential is higher for a tree to be “hit” twice if it is attacked in May, at the start of beetle activity. Chances are good that the beetles will get back to that tree a second time before going into diapause for the winter. Data collected for the past two years, along with data collected over the next few years would be critical in definitively answering this question. (Determined from database analysis - 2 wks.)

We have the beginnings of a long-term data-monitoring program. This proposal would allow us to expand and improve upon our existing database that land managers could use for making informed decisions.

A break in this monitoring program would greatly diminish the value of our existing data and would also decrease the value of any future data collection because of changes in conditions from the initial releases.

Objectives: Maintain a continuous program of study addressing various aspects of beetle-tamarisk interactions and for maintaining the value and integrity of the developing, baseline data files that can play a key role in helping to safeguard our fragile desert ecosystems.

Relevance to Strategic Plans: WAP focus areas include; Lowland riparian habitat, Wetland habitat, Mountain riparian habitat, Shrubsteppe habitat, Flowing water habitat. Other plans include: BLM Invasives, Fire, and Range Management Plans; SE Utah Tamarisk Partnership Strategic Plan; National Park Service Invasive Species, Resource Stewardship, and Watershed Monitoring Plans.

Potential Risks: It takes at least three to five years of beetle herbivory to kill tamarisk, monitoring should continue until significant mortality is documented throughout Grand County. Currently, 2 years of data has been collected.

Proposed Methods: Data from 2008 will be reviewed in early April to develop a strategy for tracking beetles once they became active in 2009. Based on where beetle numbers were high late in the 2008 season, and on our diapause study data, we can estimate where spring beetle concentrations would be likely to occur. These areas will be targeted for early monitoring. This work will be followed in early May by

a countywide survey of tamarisks to pinpoint actual pockets of high adult concentrations. Continuous monitoring of select sites will continued across much of Grand County from this initial survey until mid-October when the adults entered diapause.

Following the standard USDA APHIS protocol used in 2007 and 2008, target trees and target branches will continue to be the basis for monitoring in 2009, as it was in the previous two years. We will record beetle numbers for all three life stages that are found on the target branch as number of egg sets, larvae (larval stages will be pooled), and adults that are counted in separate 15-second intervals. We will also record the percent of the target tree canopy that is green, yellowing, defoliated (brown), re-foliating, brown a second time, and dead with these percents totaling 100. Systematic field notes about the condition of the entire tamarisk stand around the target tree, other observations of beetle abundance, behavior, etc. will supplement the basic data collected. Data will be uploaded from the GPS unit onto a desktop computer in the office each day.

During the winter of 2007-08 and fall 2008 various agencies conducted control treatments (e.g., cutting, burning, etc.) on tamarisk; where possible we will establish additional monitoring points to compare beetle activity and tamarisk response in adjacent treated re-growth and untreated mature tamarisk stands. The same monitoring methods described above will be applied at these sites.

Actual site selection for monitoring the beetle–tamarisk interactions will again be established along the Colorado, Green, and Delores Rivers at trees where data have been collected for the past two years. Sites will also be monitored at locations across the county that were visited only in 2008 when the beetles reached these areas for the first time. New sites will be created as need in 2009 to address the continued expansion of the beetle population across Grand County and into neighboring counties.
The 2009 data collection periods throughout Grand County will be kept as close to a weekly monitoring schedule as possible. Uncertainty arises, however, because Grand County has vast and often remote geographic areas that need to be covered and because unpredictable weather conditions from one part of the county can impact another – distant areas are often connected by potentially dangerous flash floods.

We will continue to document tamarisk response to beetles with digital photography. On even numbered sampling periods digital "overview" pictures will be taken from high points above Williams Bottom, the Potash Road boat ramp, the Kokopelli Trail area north of Dewey Bridge on Route 128, Mineral Bottom, and Ruby Ranch. Digital pictures will again be taken during odd numbered sampling periods at the seven routinely visited initial release sites that were monitored in both 2007 and 2008 to document the tamarisk/beetle activity at those locations through time.

Mortality surveys were conducted between September 30th and October 17th of 2008 at eleven sites in Grand County; we propose to continue monitoring, these sites and to expand this to include the full range of beetle histories (e.g., first exposed to beetles in 2004 to not exposed to beetles by the end of 2008), using these same procedures in 2009. Permanent transects, each 31.7 m long, will be established at each site. All trees within 5 m on either side of the transect line will be plotted, and classified as alive or dead; if alive, canopy condition will be recorded as percent green, etc. as described above. Perpendicular distance from the line, and canopy diameter class (small < 10 cm; medium > 10 cm < 20 cm; large > 20 cm) will be recorded for each tree.

Colonization of defoliated tamarisk stands: Sites will be established in tamarisk stands with various tamarisk beetle histories, from near the initial 2004 release sites to areas still not reached by the beetles through 2008. We will identify at least two and preferably up to five locations (depending on availability) with each beetle history under similar environmental conditions (e.g., along a major river, in a dry wash with similar substrates, etc.). At each site, we will randomly establish four 10 m transects, each beginning 1 m inside the canopy perimeter of tamarisk. Along each transect we will establish five permanent 0.5 m2 plots, on alternating sides of, with the 1 m side perpendicular to the transect; the first plot will be placed at the 1 m mark. For each plot, the following data will be collected: 1) distance of corner at transect from nearest tamarisk trunk; 2) canopy cover of tamarisk in each category used in beetle monitoring; 3) identity of all plant species growing in the plot; 4) canopy cover of each plant species rooted in the plot or with foliage hanging over the plot; 5) litter layer species composition with the top three species listed in order of abundance of litter biomass; 6) thickness of upper and lower litter layers, taken at each corner of the plot and averaged.

Evaluation of Diorhabda elongata diapause patterns: Litter samples will be collected from under target trees at select monitoring sites across Grand County. We will collect from sites with different beetle concentrations late in the 2009 season: high beetle numbers in late August/early September, high numbers in mid July, lower numbers by September, and high numbers in late May, with low or high numbers by September, to reflect areas that received a second generation attack and those that did not.
Each sample will be approximately 0.01 m2, taken to mineral soil. Where the litter has accumulated for years, the litter can be separated into two layers based on color, cohesiveness and extent of decomposition. The upper layer is comprised of material from the last one to two years, is loose and unconsolidated, and a straw yellow in color. The lower layer is compressed and matted, dark grayish to brown and less distinguishable as specific plant parts. We will collect upper and lower layers separately. Thickness of each layer for each sample will be recorded; if there is considerable difference in litter layer thickness across the sample plot then the range will be recorded. Litter is scooped by hand, removing the upper layer to the compressed upper surface of the lower layer, and then removing the lower litter layer to mineral soil. Samples will be placed in labeled paper sacks and the sack tops folded and stapled; sacks will be placed in an ice chest for transport back to the lab. Samples will be stored in a cold room at 10-13° C until they can be processed. Our experience has been that this keeps the beetles quiescent and there is little chance of beetles escaping the sacks during storage.

Samples will be sifted through a series of sieves (6 mm, 3 mm, 1.5 mm) to remove coarse debris, trap beetles and allow fine material to pass through. All material will be carefully examined for beetles. Beetles will be picked out of the samples whenever seen, placed in a storage cup, and counted after the entire sample had been examined; the number will be recorded on the datasheet with data concerning condition at the sampling site.

Beetle numbers in litter samples will be regressed on beetle numbers from target time periods of the previous summer to determine the best prior active season predictor of beetle overwintering concentrations. Litter beetle numbers will also be correlated with beetle numbers early in the next season to verify whether high overwintering beetle numbers lead to high numbers early in the next season.

Project Proposal

Shapefile Name: HPD 2010\GIS Shape Files - Proposals\SER\1415.shp **Seed Source:**

UPCD Reg Team Coord Date: 01/20/2009

Proposed NEPA Action:

Proposed Arch Action:

☑ **Vegetation Monitoring** ☑ **Wildlife Monitoring**

Monitoring Information: Grand County has a well-established ongoing beetle dispersal/tamarisk response-monitoring plan in place and we are requesting funds to assure the continuation of this program.

Grazing Management: Widespread loss of tamarisk thickets could result in more available water and more grazing plants in areas adjacent to rivers, pools, springs, and catch basins.

SPECIES BENEFITING

Southwestern Willow Flycatcher	Yellow-billed Cuckoo	Lucy's Warbler	Merriam's Wild Turkey
Northern River Otter	Bonytail	Razorback Sucker	Great Plains Toad
Northern Leopard Frog	Colorado Pikeminnow		

LAND OWNERSHIP

Owner	Acres
BLM	1558662
DOD	1630
NPS	76602
Private	105231
SITLA	348584
SL&F	5356
Tribal	198375
UDOT	11
DWR	8604
USFS	57283
USP	3321
WATER	146
Total	2363805

PROPOSED FUNDING

Source	Amount Requested	Date Approved	Amount Approved
DNR Watershed (FY10)	$53,888.00		$0.00
Other	$19,000.00		$0.00
Totals	***$72,888.00***		***$0.00***

Project Proposal

PROPOSED BUDGET

Item	Description		DWR Account	In Kind/ Partner Contrib.
Personal Services			$41,888.00	$17,000.00
Materials and Supplies			$12,000.00	$2,000.00
		Totals	***$53,888.00***	***$19,000.00***

Project Map:

Project Proposal